

New York City College of Technology
School of Arts and Sciences
Department of Biological Sciences

EVOLUTION (BIO-2250) SYLLABUS

Course Information

Course Title: EVOLUTION.

Course Code: BIO-2250.

Credits Hours: 3 credit hours.

Prerequisite: General Biology II (BIO-1201).

REQUIRED COURSE TEXTBOOK:

- *Evolution*, 4th Edition, by Douglas J. Futuyma & Mark Kirkpatrick (Sinauer Associates, 2017).

ISBN-13: 978-1605356051; ISBN-10: 1605356050.

Readings will be supplemented with PowerPoint presentations, articles from scientific journals, virtual labs, and podcasts.

SUGGESTED SUPPLEMENTAL READING:

- *Remarkable Creatures - Epic Adventures in the Search for the Origins of Species* by Sean B. Carroll (Houghton Mifflin Harcourt, 2009).

ISBN-13: 978-0547247786; ISBN-10: 0547247788

Course Description: This course leads students on a broad exploration of evolutionary science. Students review the history of evolutionary thought and science; genetics; the main mechanisms and forces that drive evolution; and the tools and findings of evolutionary research, including the evolution of humans and human behavior.

Grading Procedure (see Grading Policies for details)

Four lecture exams will be administered throughout the course. The final exam is not cumulative. The lecture exam format will be a combination of multiple choice, true/false and short answer questions.

Course Coordinator

Dr. Mercer R. Brugler	
(718) 260-5986	mbrugler@citytech.cuny.edu

Office hours are by appointment only. Please contact your professor by email first with any questions or concerns. If necessary, your professor will schedule a time to talk on the phone.

GRADING POLICIES

LECTURE EXAMS

Four lecture exams will be administered throughout the course. The final (=fourth) exam is not cumulative. The lecture exam format will be a combination of multiple choice and true/false questions.

FORUM POSTS (BLACKBOARD [OR SIMILAR])

Using the Forum tool on Blackboard, students will be expected to either 1) post questions about weekly readings, 2) respond to a question posted about the readings, 3) post a link to a current event and briefly state its relevance, or 4) respond to a current event, article, or podcast posted by your professor. Quality of participation, including facilitating and carefully considering the contributions of others, is as important as quantity. Please include your name, the date, and the time that you uploaded your post.

CURRENT EVENTS

You will be responsible for locating and presenting one evolutionary biology-related current event during the course of the semester. Oral presentations must utilize PowerPoint, Keynote, or similar software, and last no longer than 10 minutes. You will be responsible for emailing a link to the current event to your professor (mbrugler@citytech.cuny.edu) at least 72 hours in advance of class so that your fellow students have time to review the current event prior to your presentation. Here is a list of websites to locate current events: www.sciencedaily.com/news/plants_animals/evolution/, life.mcmaster.ca/brian/evoldir.html, phys.org/biology-news/evolution/, www.scientificamerican.com/evolutionary-biology/, www.newscientist.com/article-topic/evolution/, www.nytimes.com/section/science. A detailed grading rubric is available on Blackboard.

TERM PAPER

Each student must write a 4 to 5-page term paper on one of the following topics:

- Topic 1: Select a species of interest (other than humans; perhaps a species you don't know much about, or a species that you are interested in) and write about it from an evolutionary perspective. For example: What is the classification hierarchy of your organism (Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species)? What is its scientific name (Genus + Species), and what does its scientific name allude to? Where in the Tree of Life does it

fit? Which species or group of species is it most closely related to (hint: that would be the next branch on the tree with which it shares a common node)? Did its relationship to any of its evolutionary relatives surprise you, and if so, in what way? Where does your organism live? How is it adapted to its environment? Does your organism form a symbiotic relationship with another organism? Do humans use this organism – or components/extracts of this organism – for the benefit of our species? Is your organism being affected by global climate change? Etc.

- Topic 2: Select an evolutionary biologist and write about his/her contribution(s) to the field. Also include where this person worked, or where they are currently working. And, what is/was the impact of their contribution to the field and/or our society? Caveat: You must select an evolutionary biologist that meets one of the following criteria: is 1) female, or 2) a minority, or 3) a person with disabilities. For a definition of what is meant by *minority*, please see the following document (in particular, see the bottom of Page 3 – under the heading *Individuals*) produced by the National Science Foundation (NSF – [link here](#)).

You must obtain written approval from your professor prior to proceeding with your topic. Thus, email details related to your topic to your professor by Week 7. The term paper will be due on Week 13 at the beginning of class. You must submit a hard copy and digital copy; the latter will be scanned for plagiarism using TurnItIn. Evaluation criteria and specifications regarding font type / size, line spacing, margins, etc. will be provided on Week 7. Late term papers will not be accepted, and points for that assignment lost, unless special circumstances are discussed and special arrangements are agreed upon *in advance of the deadline* with your professor. A detailed grading rubric is available on Blackboard.

IN-CLASS PARTICIPATION

All students are required to attend and actively participate in every class with short / relevant questions and comments. Classes are an opportunity to engage in interesting exchanges with your professor and peers, capitalizing on the readings and the material presented in class. This course places a high premium on sustained, high-quality participation. A penalty of up to 10 points may be assessed against the final grade of a student who inappropriately disrupts or hinders class activities and discussions.

Positive qualities of participation

- You are alert and engaged, courteous and take notes
- You enter the class discussion offering substantive answers and asking thoughtful questions. Thoughtful questions show that you are prepared (e.g., non-thoughtful question: “I don’t understand anything discussed in the chapter.” What is it that you don’t understand? Do you have a specific example of something that was confusing? What is your interpretation?)
- You are courteous and take notes

Factors that affect participation negatively

- You are in class, but not engaged. You tune out, check your phone, or disappear behind your laptop screen. You sleep. You have a casual conversation with your neighbor.
- You don’t make eye contact with the professor
- You try to dominate the discussion and are dismissive
- Your questions are vague. They demonstrate you have not thought deeply about the course materials.

Attendance vs. Participation

- Attendance is a necessary condition for participation. If you miss class, arrive late or leave early, you will not receive full participation points, no matter how stellar you are in class.

ASSESSMENT STRATEGY

Lecture exams:	60 points (60% of the final grade)
Forum posts:	5 points (5% of the final grade)
Current event presentation:	10 points (10% of the final grade)
Term paper:	20 points (20% of the final grade)
In-class participation:	5 points (5% of the final grade)

GRADING SCALE

A	93-100
A-	90-92.99
B+	87-89.99
B	83-86.99
B-	80-82.99
C+	77-79.99
C	70-76.99
D	60-69.99
F	59.99 and below

EXTRA CREDIT

Extra credit is not offered in this course.

EVOLUTIONARY BIOLOGY-RELATED FILMS

We will spend ~15 minutes of every class viewing an evolutionary biology-related film that is directly related to the material being presented in the textbook. The films that have been chosen are as follows...

EVOLUTION - A 7-SHOW MINISERIES (PREMIERED 09/24/2001 ON PBS)

Evolution determines who lives, dies, and passes traits on to the next generation. The process plays a critical role in our daily lives, yet it is one of the most overlooked, and misunderstood, concepts ever described. This miniseries travels the world to examine evolutionary science and the profound effect it has had on society and culture. See http://www.pbs.org/wgbh/evolution/about/overview_series.html.

YOUR INNER FISH – A 3-PART SERIES BY NEIL SHUBIN (PREMIERED 04/09/2014 ON PBS)

Have you ever wondered why the human body looks the way it does? Why our hands have five fingers instead of six? Why we walk on two legs instead of four? It took more than 350 million years for the human body to take shape. How did it become the complicated, quirky, amazing machine it is today? Your Inner Fish delves into the past to answer these questions and reveals that hidden within the human body is a story of life on Earth. See <http://www.pbs.org/your-inner-fish/about/overview/>.

RADIOLAB

Radiolab, WNYC's Peabody Award-winning program about big ideas, is hosted by Jad Abumrad and Robert Krulwich and produced by WNYC Studios. One of the first podcasts that you will listen to is entitled 'Antibodies Part 1: CRISPR' (length: 32:17; www.radiolab.org/story/antibodies-part-1-crispr/). CRISPR is a method of genetic manipulation that is rewriting the way we change DNA. Scientists say they'll someday be able to use CRISPR to fight cancer and maybe even bring animals back from the dead. You can satisfy your weekly Forum post by commenting on a Radiolab podcast.

ATTENDANCE AND LATENESS

Attendance and prompt arrival to class are mandatory. If you are absent from class, you are responsible for all material discussed in the class you missed. If you plan to miss any classes for religious observance, please let your professor know their dates before the second class meeting. Your professor will not penalize you for these absences, but may require you to submit any assignments in advance.

ABSENCES IN EXCESS OF 10% OF THE TOTAL LECTURE HOURS WILL RESULT IN YOU BEING DROPPED FROM THE COURSE WITH A FAILING GRADE (=WU, UNOFFICIAL WITHDRAWAL). This means that no more than 3 lecture absences will be tolerated. It is expected that you will be in your seat and ready to work at the start of each period and that you will not leave the lecture early. Any 2 latenesses will be considered equal to 1 absence. Attendance will be taken at the beginning of every class. If you are late, it is your responsibility to notify the instructor at the end of class. It is also your responsibility to keep track of how many lates and absences you have accumulated. Please email your professor (mbrugler@citytech.cuny.edu) if you are unsure of your total number of absences.

COMMUNICATION POLICY

Students must use their City Tech email account (or Blackboard course-mail) to communicate with the professor. The professor will make every effort to respond to all email inquiries within 24 hours.

LECTURE EXAMS

Lecture exams will be at least one hour long and consist of at least 50 questions (multiple choice, true/false and short answer). If you are late to a lecture exam, you will be able to pick up an exam up until the time when the first student hands in his/her exam. After that point, exams will no longer be administered. Please bring at least one #2 pencil and an eraser to each exam. You cannot use a pen to fill in bubbles on a scantron. Your professor will provide you with a scantron. Scantrons will be collected promptly at the end of class. You will not be allowed to bubble in answers after time is called (i.e., make sure you have indicated all of your answers on the scantron by the end of class). If you wear a baseball cap to the exam, you must rotate your cap so the brim faces backwards (so the professor can see your eyes). You must remove and store any ear buds, headphones, and sunglasses, and put away calculators and cell phones. All grades are counted; none are dropped nor are they curved.

MAKE-UP EXAMS

The biology department has a no make-up policy. Thus, make-up exams are a rare and exceptional occurrence. Make-up exams are given at the discretion of the instructor. You must contact the instructor ahead of the exam you will miss to determine your eligibility for a make-up exam, and, if eligible, schedule your make-up exam and discuss the format (essay). You must provide written proof of reason for your absence (i.e., acceptable documentation). If you did not contact your instructor ahead of a missed exam, you will not be allowed to take a make-up exam.

ACADEMIC INTEGRITY POLICY

Academic dishonesty includes any act that is designed to obtain fraudulently, either for oneself or for someone else, academic credit, grades, or any other form of recognition that was not properly earned. Academic dishonesty encompasses the following:

Cheating: Defined as intentionally giving, receiving, using or attempting to use unauthorized materials, information, notes, study aids, including any form of unauthorized communication, in any academic exercise. It is the student's responsibility to consult with instructors to determine whether or not a study aid or device may be used.

Plagiarism: Plagiarism is intentionally and knowingly presenting the ideas or works of another as one's own original idea or works in any academic exercise without proper acknowledgement of the source. The purchase and submission of a term paper, essay, or other written assignment to fulfill the requirements of a course violates section 213-b of the State Education Law. This also applies to the submission of all or substantial portions of the same academic work previously submitted by the student or any other individual for credit at another institution, or in more than one course.

All required assignments in this course will be checked for plagiarism using TurnItIn

COURSE OBJECTIVES

What were Darwin's findings? Are his findings still relevant today? How could he have come up with the idea of 'evolution through natural selection' if he did not know about DNA or how heredity works? And how does heredity work? Now that we have decoded the human genome, what do we know - and still don't know - about ourselves?

LEARNING OUTCOMES

Upon satisfactory completion of this course, the student will be able to:

- Describe what science is (including its limitations) and how it applies to evolutionary biology
- Explain how DNA is structured and how heredity works, in simple terms
- Describe all of the mechanisms by which evolution acts and a real life example of each
- Define natural selection in your own words, and apply that definition to explain the evolution of a particular trait or behavior
- Outline the main events and questions in human evolution

- Use critical thinking and the best available information to frame and investigate a question related to evolution and its significance to us today

Over the course of the semester, students will also develop the following skills that are important in both science and professional life: active and critical reading, written communication skills, project management and coordination, synthesis of information, collaboration with peers, and peer evaluation.

CITY TECH GENERAL EDUCATION COMMON CORE LEARNING OUTCOMES

Upon satisfactory completion of this course, the student will be able to:

1. Use Biology as a forum for the study of values, ethical principles, and the physical world.
2. Show curiosity and the desire to learn.
3. Engage in an in-depth, focused, and sustained program of study.
4. Employ scientific reasoning and logical thinking.
5. Derive meaning from experience, as well as gather information from observation.
6. Understand and employ both quantitative and qualitative analysis to describe and solve problems, both independently and cooperatively.
7. Understand and navigate systems.
8. Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means.
9. Value knowledge and learning.
10. Demonstrate intellectual honesty and personal responsibility.

CUNY PATHWAYS COMMON CORE LEARNING OUTCOMES

Upon satisfactory completion of this course, the student will be able to:

1. Identify and apply the fundamental concepts and methods of a life science.
2. Apply the scientific method to explore natural phenomena, including hypothesis development, observation and data presentation.
3. Use the tools of a scientific discipline to carry out collaborative laboratory investigations.
4. Gather, analyze, interpret data & present it in an effective written laboratory or fieldwork report
5. Identify & apply research ethics & unbiased assessment in gathering & reporting scientific data.

Discipline Specific

LEARNING OUTCOMES	ASSESSMENT
Describe what science is (including its limitations) and how it applies to evolutionary biology	Analysis of student performance on lecture exams
Explain how DNA is structured and how heredity works, in simple terms	Analysis of student performance on lecture exams
Define natural selection in your own words, and apply that definition to explain the evolution of a particular trait or behavior	Analysis of student performance on lecture exams
Outline the main events and questions in human evolution	Analysis of student performance on lecture exams
Use critical thinking and the best available information to frame and investigate a question related to evolution and its significance to us today	Analysis of student understanding and in-depth presentation of a current event
Use Biology as a forum for the study of values, ethical principles, and the physical world	Weekly discussions and analysis of weekly online contributions to the Forum

General Education

LEARNING OUTCOMES	ASSESSMENT
Show curiosity and the desire to learn	Weekly discussions and analysis of weekly online contributions to the Forum
Engage in an in-depth, focused, and sustained program of study	Weekly discussions and analysis of weekly online contributions to the Forum
Employ scientific reasoning and logical thinking	Analysis of student performance on lecture exams
Derive meaning from experience, as well as gather information from observation	Analysis of student performance on the term paper
Understand and employ both quantitative and qualitative analysis to describe and solve problems, both independently and cooperatively	Analysis of student performance on lecture exams
Understand and navigate systems	Analysis of student understanding and in-depth presentation of a current event
Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means	Weekly discussions and analysis of weekly online contributions to the Forum
Value knowledge and learning	Weekly discussions and analysis of weekly online contributions to the Forum. Analysis of the careful consideration of the contribution of others both in-person and online
Demonstrate intellectual honesty and personal responsibility	Analysis of student performance (particularly related to plagiarism) on the term paper
Identify and apply the fundamental concepts and methods of a life science	Weekly discussions and analysis of weekly online contributions to the Forum
Apply the scientific method to explore natural phenomena, including hypothesis development, observation and data presentation	Weekly discussions and analysis of weekly online contributions to the Forum
Use the tools of a scientific discipline to carry out collaborative laboratory investigations	Analysis of student performance using SimBio (or similar) interactive virtual experiments
Gather, analyze, interpret data & present it in an effective written laboratory or fieldwork report	Analysis of student performance on the term paper
Identify & apply research ethics & unbiased assessment in gathering & reporting scientific data	Analysis of student understanding and in-depth presentation of a current event

LECTURE SCHEDULE

WEEK	TOPIC
1	<p>An Idea that Changed the World</p> <ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 1: Evolutionary Biology (Pages 3-24) • Tree of Life Web Project (http://tolweb.org/tree/learn/concepts/concepts.html). Review the following pages in the section <i>Learn About Evolution & Phylogeny</i>: 1) What is Phylogeny?, 2) Genetic Connections Between Organisms, and 3) Phylogeny or Classification: What is the Tree of Life about?
2	<ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 2: The Tree of Life (Pages 27-53) • Futuyma & Kirkpatrick, Chapter 3: Natural Selection & Adaptation (Pages 55-76) • Current event presentation(s) • Tree-Thinking Challenge (Baum DA, Smith SD, Donovan SS, 2005. <i>Science</i> 310, 979, DOI: 10.1126/science.1117727). Article freely available here: http://www.myteacherpages.com/webpages/jflynt/files/basic%20tree%20thinking%20asessment.pdf
3	<p>How Evolution Works</p> <ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 4: Mutation & Variation (Pages 79-101) • Futuyma & Kirkpatrick, Chapter 5: The Genetical Theory of Natural Selection (Pages 103-133) • Current event presentation(s) • National Geographic article by David Quammen entitled “Was Darwin Wrong?” Article freely available here: http://ngm.nationalgeographic.com/2004/11/darwin-wrong/quammen-text
4	<p>Week 4: EXAM 1 (Chapters 1-5) – Administered at the beginning of class</p> <ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 6: Phenotypic Evolution (Pages 135-163) • Current event presentation(s)
5	<ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 7: Genetic Drift: Evolution at Random (Pages 165-189) • Futuyma & Kirkpatrick, Chapter 8: Evolution in Space (Pages 191-211) • Current event presentation(s) • University of Utah’s <i>Tour of Basic Genetics</i>: http://learn.genetics.utah.edu/content/basics/
6	<ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 9: Species & Speciation (Pages 213-244) • Current event presentation(s) • Understanding Evolution: http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_14
7	<p>Products of Evolution: What Natural Selection Has Wrought</p> <ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 10: All About Sex (Pages 247-272) • Futuyma & Kirkpatrick, Chapter 11: How To Be Fit (Pages 275-293) • Current event presentation(s) • Must e-mail term paper topic to your professor by this date (mbrugler@citytech.cuny.edu) • The Professor will distribute evaluation criteria and specifications for the term paper

8	<p>Week 8: EXAM 2 (Chapters 6-11) – Administered at the beginning of class</p> <ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 12: Cooperation & Conflict (Pages 295-318) • Current event presentation(s)
9	<ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 13: Interactions Among Species (Pages 321-343) • Futuyma & Kirkpatrick, Chapter 14: The Evolution of Genes & Genomes (Pages 345-367) • Current event presentation(s)
10	<p>Macroevolution and the History of Life (<i>starting with Chapter 16</i>)</p> <ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 15: Evolution & Development (Pages 369-398) • Futuyma & Kirkpatrick, Chapter 16: Phylogeny: The Unity & Diversity of Life (Pages 401-429) • Current event presentation(s)
11	<ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 17: The History of Life (Pages 431-467) • Current event presentation(s)
12	<p>Week 12: EXAM 3 (Chapters 12-17) – Administered at the beginning of class</p> <ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 18: The Geography of Evolution (Pages 469-488) • Current event presentation(s)
13	<ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 19: The Evolution of Biological Diversity (Pages 491-512) • Futuyma & Kirkpatrick, Ch 20: Macroevolution: Evolution Above the Species Level (Pgs 515-544) • Current event presentation(s) • Term paper is due at the start of class
14	<p>Evolution and <i>Homo sapiens</i></p> <ul style="list-style-type: none"> • Futuyma & Kirkpatrick, Chapter 21: The Evolutionary Story of <i>Homo sapiens</i> (Pages 547-570) • Futuyma & Kirkpatrick, Chapter 22: Evolution & Society (Pages 573-602) • Current event presentation(s)
15	<p>The Big Picture</p> <ul style="list-style-type: none"> • Current event presentation(s) • Synthesis and reflection <p>Week 15: EXAM 4 - FINAL (Chapters 18-22) – Administered at the <u>end</u> of class</p>